

The Unequal Responses to Pandemic-Induced Schooling Shocks

Andrea Flores and George-Levi Gayle

Abstract

This article investigates the existence of socio-demographic gradients in the schooling shocks experienced by school-aged children and their ability to adjust to the disruptions induced by the containment measures imposed in response to the COVID-19 pandemic. It focuses on documenting racial, educational, and income disparities in these two essential components of children's human capital accumulation that could have significant implications in the medium and long run. The article finds that children in households from disadvantaged socio-demographic groups (i) were significantly more likely to face severe education disruptions from school cancellations at the onset of the pandemic, (ii) had more-limited access to remote-learning resources such as computers, and (iii) relied more heavily on schools to obtain access to these resources. Notably, these adverse effects severely disrupted children's 2019-20 academic year but were mitigated at the start of the 2020-21 academic year.

JEL Codes: I24, I26, I28

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1. INTRODUCTION

The literature has often emphasized the role of schools as social equalizers in providing students from disadvantaged families with improved access to educational resources and the ability to socialize with peers of different socio-economic backgrounds. Disparities in these aspects of children's human capital accumulation tend to have an unequal effect on children's educational outcomes in the medium and long run—primarily through differences in parents' ability to make the necessary investments to help their children adapt to alternative learning formats. In this article, we investigate the existence of socio-demographic gradients in children's learning formats and access to computers during the first two school years affected by the pandemic, which jeopardized the equalizing role of schools. We build on the data and analysis presented in a companion article (Flores and Gayle, 2022) to show that the disparate impact of COVID-19 on employment that we document in that article aligns with the socio-demographic gradients we find in children's education disruptions and access to educational resources during the pandemic.

Our analysis builds on the strand of the literature focusing on the impact of education disruptions on children's human capital, which investigates how test scores and college entrance outcomes are affected by the academic disruptions caused by natural disasters such as hurricanes. The pandemic shock mimicks the impact of a natural disaster mainly in the form of the education disruptions generated by both shocks. For instance, Sacerdote, 2012 finds an immediate one-year decline in math test scores among evacuees from New Orleans

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affected by Hurricane Katrina, who were from disproportionately poor and low-scoring school districts. Such an adverse short-term effect was expected since students lost around five school weeks. Furthermore, his results suggest that students reassigned to wealthier and higher-scoring schools were able to compensate for these short-term adverse effects, highlighting the equalizing role of schools.

Nonetheless, the main point of departure of the pandemic shock from a shock generated by a natural disaster is the absence of schools as an equalizer amid school closures implemented to contain the spread of the virus. In this way, as Kuhfeld et al., 2020 argue, the disparities in children's education induced by the pandemic shock are instead expected to mimic the disparities documented by seasonal learning studies, due to the underlying inequities in the access to academic resources and to a proper learning environment at home in the absence of in-person instruction. Thus, it is highly likely that there will exist substantial education lags among socio-demographic groups that could not fully compensate for the lack of in-person instruction and who might have been more likely to face financial hardships during the pandemic.

Documenting the disparities observed in children's ability to adjust to the different pandemic-related education disruptions is relevant since the disparities could translate into socio-demographic gaps in medium- and long-term education outcomes. For instance, Maldonado and De Witte, 2020 evidence on the impact of school closures in Belgium on students' scores in standardized tests indicate an overall decline in math and language scores. The authors also provide evidence of a fall in overall grade point averages (GPAs) associated with school closures, with higher losses concentrated among students from disadvantaged socio-economic groups. There are similar results documented in the Netherlands (Engzell, Frey, and Verhagen, 2021). The literature has listed two plausible drivers of these negative effects on children's education outcomes. The first one pertains to the deterioration of children's peer networks due to school closures (Grewenig et al., 2020 and Agostinelli et al., 2020).¹ The second one pertains to limitations on children's access to educational resources—related to both parental time and monetary investments in children's education—for adapting to alternative learning formats (Andrew et al., 2020, Boca et al., 2020, and Sevilla and Smith, 2020).

Our analysis exploits the availability of detailed information on the types of education disruptions faced by school-aged children in U.S. households during the pandemic, including the cancellation of classes. Additionally, the survey also collects information on the availability of active learning resources, such as computers, and how these resources were provided. The information in the survey allows us to investigate how well-equipped children were to adjust to alternative learning formats adopted in response to the schooling shocks generated by the pandemic. The information in the survey also allows us to study to what extent schools can help overcome limitations that parents from disadvantaged socio-demographic groups have in securing access to a computer.

We find that children in households of non-White respondents were more likely to have had their classes cancelled at the onset of the pandemic. In addition, these children were also considerably less likely to have had their classes switched to a remote format, significantly disrupting the end of their 2019–20 academic year. In fact, for children in these households, we find that the switch to remote learning most likely did not occur until the start of the 2020–21 academic year. We document a similar pattern for household income (when comparing households in the two extremes of the income distribution) and respondents' education (when comparing families of respondents without a college degree and college graduates).

Our results also indicate that children in households of non-White respondents or in households of respondents without a college degree were significantly less likely to have access to a computer for educational purposes during the pandemic, especially at its onset. Furthermore, we find that a household's probability of having a computer for educational purposes significantly increases with household income. Such observed income and education gradients resemble the strong relationship in the United Kingdom between income and remote-learning resources documented by Andrew et al., 2020. More importantly, among households in which children have access to a computer, those in the aforementioned socio-demographic groups were more likely to rely on schools as the primary providers of this resource.

Overall, the socio-demographic gradients we find in education disruptions and children's access to learning resources strongly align with the disparities documented in Flores and Gayle, 2022. Specifically, the documented disparities reflect the pandemic's unequal impact relative to significant losses in earned income, the likelihood of having at least one adult household member switch to remote work in response to stay-at-home ordinances, and the incidence of food insecurity exacerbated by the pandemic. The households whose children faced relatively more severe education disruptions and who were more constrained in accessing remote-

1. Grewenig et al., 2020 show that low-achieving students tend to be disproportionately more adversely affected than their high-achieving peers in the absence of an educator's support. The results in Agostinelli et al., 2020 show a similar pattern for the United States. When quantifying the impact of the loss of one friend in terms of GPA growth, Agostinelli et al., 2020 find that the loss of a friend is associated with a loss of more than 10% in GPA growth, with the negative effects being larger for low-achieving students. The authors argue that high-achievers tend to be more resilient when losing contact with a friend, based on evidence from the United States, and to losing contact with an educator, based on evidence from Germany.

learning resources, such as computers, that are conducive to alternative learning formats were precisely the families more severely affected in terms of employment.

The remainder of the article proceeds as follows. Section 2 describes the data sources used to conduct the analysis presented in this article and describes the empirical strategy implemented to quantify the disparities documented in our results. Section 3 presents trends in education disruptions experienced by school-aged children in surveyed households and shows how these trends differ across socio-demographic groups during the pandemic. Section 4 documents trends in children’s access to computers as well as trends in the providers of these learning resources. Lastly, Section 5 concludes.

2. DATA AND EMPIRICAL STRATEGY

2.1 Data Sources

Throughout the analysis implemented in this article, we rely on the dataset constructed in our companion article Flores and Gayle, 2022. The dataset uses the public-use files of the Census Bureau’s Household Pulse Survey (hereafter the Pulse).² While there have been at least four additional rounds added to the initial three phases of the survey, we use the data files released for the first three phases of the survey collected between April 23, 2020, and March 29, 2021, spanning the first 27 weeks of the survey. Specifically, we primarily use the combination of household-level and individual-level information on respondents’ socio-demographic characteristics and on the types of education disruptions and access to educational resources faced by children in respondents’ households, to investigate whether there exist gradients in household responses to the schooling shocks generated by the pandemic. Importantly, we use the same variables capturing socio-demographic characteristics as defined in our companion article.

Since lockdowns imposed in response to the pandemic thwarted efforts to conduct face-to-face interviews, alternative data collection methods deployed during the pandemic have involved online surveys. Specifically, in the strand of the literature focusing on changes in children’s schooling and parental investments in children’s education during the pandemic, Andrew et al., 2020 use online time diaries, surveying 5,582 parents in England living with at least one school-aged child during the period April 29, 2020, to June 20, 2020, to collect information on family demographic and socio-economic characteristics as well as on children’s home-learning activities and resources. The authors construct weights using data from the nationally representative Labour Force Survey to correct for potential sampling bias. Such potential sampling bias is a concern since a potential shortcoming of mobile/online data collection is the extent to which there exist disparate response patterns across different socio-demographic groups. To address concerns related to this type of bias, the Census Bureau has provided sampling weights in each release of the public-use files, as detailed in Peterson et al., 2021.³ We apply these sampling weights throughout the empirical analysis implemented in this article.

We use the information available in the Pulse regarding education disruptions, computer availability, and the extent to which schools have been able to provide access to computers during the pandemic. Since we use data from the Pulse spanning April 2020–March 2021, the academic year of reference changed during the survey. Thus, during the first 12 survey weeks of the Pulse, the academic year captured in the survey is the 2019–20 academic year. With the start of fall 2020, survey weeks 13–27 switched to the 2020–21 academic year. We account for this shift in the regression analyses implemented throughout this article. Thus, the data we use in our study allow us to capture the types of education disruptions experienced by children during two academic years and the extent to which schools were able to adjust to the social distancing measures adopted for the containment of the virus at the start of the 2020–21 academic year.

We supplement the Pulse data with state-level information on the number of COVID-19 cases and mobility obtained from the COVID Tracking Project, the Centers for Disease Control and Prevention Case Surveillance public-use data, and Google’s Mobility Reports. The mobility data has been used in the literature to analyze cross-country differences that capture changes in mobility in response to the different types of measures imposed to contain the community spread of the virus and compliance with such measures as described in (Bargain and Aminjonov, 2020).

2.2 Empirical Strategy

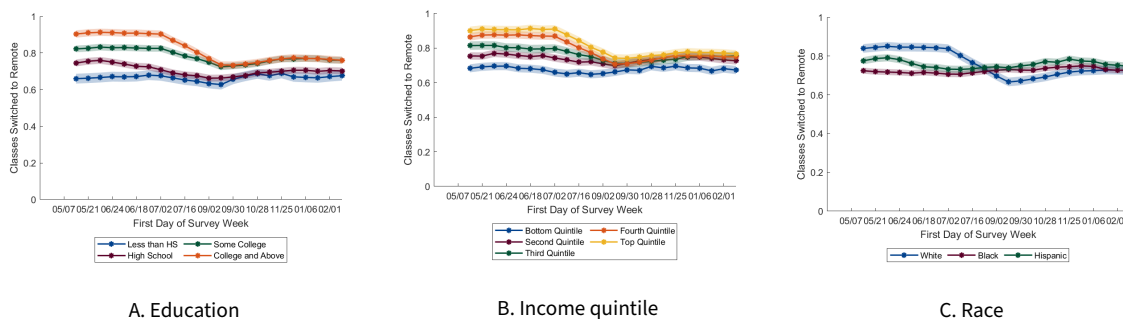
For the analysis implemented in this article, we consider a variation of the specification implemented in Angelucci et al., 2020. Specifically, we implement the following linear regression model:

$$Y_{it} = \alpha + \gamma 1\{\text{AY 2020-21}\} + \beta_G G_i + \beta_{Gt} 1\{\text{AY 2020-21}\} \times G_i + \beta X_{it} + \eta_t + \eta_s + \nu_{st} + \epsilon_{it},$$

2. The public-use files can be retrieved from <https://www.census.gov/programs-surveys/household-pulse-survey/datasets.html>.

3. Further technical information can be found at <https://www.census.gov/programs-surveys/household-pulse-survey/technical-documentation.html>.

Figure 1. How Did the Pandemic Affect the Way in Which Children Learn? Switch to Remote Learning



NOTE: Equally weighted five-survey week moving averages are presented. Less than HS, less than a high school diploma; high school, high school graduate; college and above, bachelor’s degree or higher.

where G_i includes indicators of individual i ’s socio-demographic characteristics including education, race, and income quintile, and X_{it} denotes other socio-demographic characteristics of the individual and household. Furthermore, η_t denotes survey week fixed effects, η_s denotes state fixed effects, and v_{st} denotes time-varying state characteristics. Among the latter, we consider the total number of new COVID-19 cases reported in state s during period t and the different indices of geographic mobility documented for state s during period t . Thus, for socio-demographic group G , the coefficient of interest throughout the analysis is captured by β_G . $1\{\text{AY 2020-21}\}$ is an indicator of whether the 2020–21 academic year (a later stage of the pandemic) is the one captured in the survey week. Thus, for socio-demographic group G , there are two coefficients of interest that capture the impact of the pandemic on children’s education at two different stages: β_G captures the impact on group G ’s education-related outcomes at the onset of the pandemic (i.e., the 2019–20 academic year), and β_{Gt} captures the impact on group G ’s education-related outcomes in the later stage (i.e., the 2020–21 academic year), which is when schools and families would have had relatively more time to adjust to the limitations generated by the pandemic.

3. CHANGES IN LEARNING FORMAT

We use the information on education disruptions available in the Pulse to document changes in learning format experienced during the pandemic. With respect to household income and respondents’ race and education, we find noticeable differences in the disruptions experienced by children in the remainder of the 2019–2020 academic year.

3.1 Switch to Remote Learning

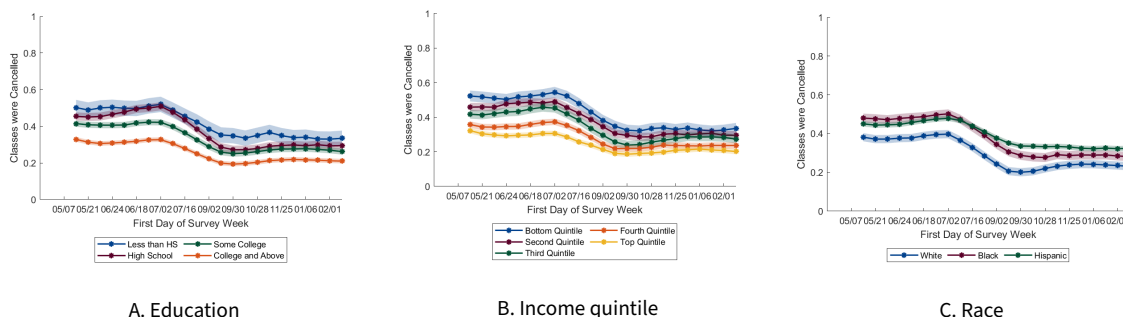
Figure 1 presents the socio-demographic gradients in the incidence with which school-aged children’s classes switched to remote learning during the pandemic. Table 1 presents the results obtained upon implementing a linear probability model (LPM) on this type of education disruption, to assess the robustness of these gradients to the inclusion of other household and individual characteristics.

Concerning disparities relative to respondents’ education, in more than 80% of households in which the respondent has a bachelor’s degree or higher and in which children were enrolled in school in February 2020, at least one child in the household experienced a shift toward a remote learning, while just over 60% of children in households in which the respondent has less than a high school diploma experienced such a change. The LPM results presented in Column 7 of Table 1 show that such a shift in the education disparities is documented for both academic years of interest and persists when controlling for other household characteristics. In particular, we find that the likelihood of classes switching to remote learning during the 2019–2020 academic year monotonically increased with the respondents’ education. We then observe that, relative to the 2019–20 academic year, this educational gradient reversed during the 2020–21 academic year.

A similar gap can be observed between the two extremes of the income distribution: The percentage of households in which children’s classes were switched to remote learning monotonically increased with household income during the 2019–2020 academic year but decreased with household income during the 2020–21 academic year. This finding persists even after controlling for other household characteristics, as shown in Column 7 of Table 1.

The remote-learning gap observed between White and non-White respondents’ households is narrower than the ones observed relative to income and education: The gap is wider between Black and White re-

Figure 2. How Did the Pandemic Affect the Way in Which Children Learn? Classes Were Cancelled



NOTE: Equally weighted five-survey week moving averages are presented.

spondents than between Hispanic and White respondents. Moreover, the racial gap reversed at the start of the 2020–21 school year: The percentages of Black respondents’ households and Hispanic respondents’ households for which children’s classes remained in a remote-learning format remained steadily above 71% and 72%, respectively, while the percentage of White respondents’ households in which children’s classes were moved to a distance-learning format fell slightly, remaining just below 70%. That is, a higher percentage of White households than non-White households reported that schools were open for in-person learning at the start of the 2020–21 academic year.

3.2 Class Suspension

Figure 2 presents the socio-demographic gradients in the incidence with which school-aged children’s classes were cancelled during the pandemic. Table 2 presents the LPM results obtained for this type of education disruption, to assess the robustness of these gradients to the inclusion of other household and individual characteristics.

As observed in Figure 2, with the shelter-in-place ordinances enacted at the start of the pandemic, around 50% of households reported the suspension of children’s classes at the beginning of the pandemic.⁴ The income and education gradients observed in the transition to remote learning are then reversed as a higher percentage of households in which the respondent has less than a high school diploma report that children’s classes were cancelled. Similarly, the fraction of households in which children’s classes were cancelled decreases with household income. Importantly, we find suggestive evidence that the schools of children from the socio-demographic groups more likely to have their classes cancelled toward the end of the 2019–20 academic year were better able by the start of the 2020–21 academic year to adjust to the limitations imposed by the pandemic. Specifically, we observe that the incidence of cancelled classes was significantly lower among these groups at the start of the 2020–21 academic year.

3.3 Schools Remaining Open

Figure 3 presents the socio-demographic gradients in the incidence with which school-aged children’s schools remained open for in-person instruction during the pandemic. Table 3 presents the LPM results obtained for this type of instruction to assess the robustness of disparities to the inclusion of other household and individual characteristics.

As some schools reopened for the 2020–21 academic year, the percentage of households in which children attended school normally (in person) increased at the start of the school year in August/September, especially since, although some states issued state-ordered in-person instruction, most left the choice to the discretion of each school district.⁵ The overall percentage of households in which children’s classes were cancelled fell. In terms of the incidence of children attending school normally because their schools were open, there are no noticeable gaps with respect to household income and respondents’ education, but there is a noticeable racial gap between households of non-White and White respondents, as more White households than non-White household reported that their schools were open.

4. This finding might reflect differences in states’ education funding that could have constrained public schools’ capacity to make an adequate transition to remote learning and thus we might want to check for geographical differences behind the observed disparities.
 5. [https://ballotpedia.org/School_responses_to_the_coronavirus_\(COVID-19\)_pandemic_during_the_2020-2021_academic_year](https://ballotpedia.org/School_responses_to_the_coronavirus_(COVID-19)_pandemic_during_the_2020-2021_academic_year)

Table 1. Switch to Remote Learning, with 2020-21 Academic Year Interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Remote	Remote	Remote	Remote	Remote	Remote	Remote
1(Black)	-0.123*** (0.008)			-0.073*** (0.008)	-0.100*** (0.008)	-0.074*** (0.008)	-0.080*** (0.008)
1(Hispanic)	-0.113*** (0.008)			-0.072*** (0.008)	-0.068*** (0.008)	-0.053*** (0.008)	-0.048*** (0.008)
1(Other race)	-0.040*** (0.010)			-0.040*** (0.010)	-0.050*** (0.010)	-0.046*** (0.010)	-0.035*** (0.010)
1(2020-21 academic year)	-0.110*** (0.011)	-0.119*** (0.012)	-0.119*** (0.011)	-0.150*** (0.012)	-0.161*** (0.011)	-0.163*** (0.012)	-0.005 (0.023)
1(Black)×1(2020-21 academic year)	0.170*** (0.011)			0.136*** (0.011)	0.154*** (0.010)	0.135*** (0.011)	0.141*** (0.011)
1(Hispanic)×1(2020-21 academic year)	0.140*** (0.010)			0.115*** (0.010)	0.118*** (0.010)	0.108*** (0.010)	0.096*** (0.010)
1(Other race)×1(2020-21 academic year)	0.127*** (0.012)			0.128*** (0.012)	0.134*** (0.012)	0.132*** (0.012)	0.112*** (0.012)
1(Bottom quintile)		-0.216*** (0.009)		-0.185*** (0.009)		-0.109*** (0.010)	-0.131*** (0.010)
1(Second quintile)		-0.143*** (0.007)		-0.117*** (0.007)		-0.056*** (0.008)	-0.071*** (0.008)
1(Third quintile)		-0.086*** (0.007)		-0.071*** (0.007)		-0.025*** (0.007)	-0.035*** (0.007)
1(Fourth quintile)		-0.028*** (0.005)		-0.022*** (0.005)		0.003 (0.005)	-0.002 (0.005)
1(Bottom quintile)×1(2020-21 academic year)		0.153*** (0.012)		0.105*** (0.012)		0.064*** (0.013)	0.074*** (0.013)
1(Second quintile)×1(2020-21 academic year)		0.122*** (0.010)		0.084*** (0.010)		0.046*** (0.010)	0.054*** (0.011)
1(Third quintile)×1(2020-21 academic year)		0.069*** (0.009)		0.050*** (0.009)		0.017* (0.010)	0.024** (0.010)
1(Fourth quintile)×1(2020-21 academic year)		0.017** (0.007)		0.011* (0.007)		-0.008 (0.007)	-0.003 (0.007)
1(Less than high school diploma)			-0.241*** (0.012)		-0.213*** (0.012)	-0.168*** (0.012)	-0.168*** (0.012)
1(High school diploma)			-0.164*** (0.006)		-0.150*** (0.006)	-0.116*** (0.007)	-0.115*** (0.006)
1(Some college)			-0.077*** (0.004)		-0.067*** (0.004)	-0.045*** (0.004)	-0.046*** (0.004)
1(Less than high school diploma)×1(2020-21 academic year)			0.148*** (0.017)		0.102*** (0.017)	0.072*** (0.018)	0.070*** (0.018)
1(High school diploma)×1(2020-21 academic year)			0.112*** (0.008)		0.093*** (0.008)	0.068*** (0.009)	0.069*** (0.009)
1(Some college)×1(2020-21 academic year)			0.077*** (0.005)		0.065*** (0.005)	0.049*** (0.006)	0.048*** (0.006)
Household size							0.003* (0.002)
Number of children							0.004 (0.002)
1(Female, respondent)							0.022*** (0.003)
1(Married, respondent)							-0.018*** (0.004)
State average mobility, retail							0.835*** (0.116)
State average mobility, transit							-0.600*** (0.105)
State average mobility, grocery							0.436*** (0.093)
State average mobility, workplaces							-0.352*** (0.089)
State average mobility, residential							0.893*** (0.112)
Average number of new cases, state							-0.044** (0.020)
Constant	0.755*** (0.013)	0.807*** (0.013)	0.804*** (0.013)	0.821*** (0.013)	0.832*** (0.013)	0.840*** (0.013)	0.791*** (0.018)
Survey week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	451,951	451,951	451,951	451,951	451,951	451,951	451,951

Notes: Stars denote statistical significance. * for p<.10, ** for p<.05, and *** for p<.01. Standard errors in parentheses.

Table 2. Classes Were Cancelled, with 2020-21 Academic Year Interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled
1(Black)	0.102*** (0.009)			0.048*** (0.009)	0.080*** (0.009)	0.049*** (0.009)	0.046*** (0.009)
1(Hispanic)	0.072*** (0.009)			0.025*** (0.009)	0.034*** (0.009)	0.014 (0.009)	0.015 (0.009)
1(Other race)	-0.029** (0.012)			-0.028** (0.012)	-0.016 (0.012)	-0.020* (0.012)	-0.017 (0.012)
1(2020-21 academic year)	-0.179*** (0.012)	-0.125*** (0.013)	-0.134*** (0.012)	-0.136*** (0.013)	-0.141*** (0.013)	-0.128*** (0.013)	-0.083*** (0.027)
1(Black)×1(2020-21 academic year)	-0.035*** (0.011)			-0.007 (0.011)	-0.022** (0.011)	-0.006 (0.011)	-0.002 (0.011)
1(Hispanic)×1(2020-21 academic year)	0.039*** (0.011)			0.059*** (0.011)	0.054*** (0.011)	0.062*** (0.011)	0.054*** (0.011)
1(Other race)×1(2020-21 academic year)	0.042*** (0.014)			0.041*** (0.014)	0.037*** (0.014)	0.038*** (0.014)	0.026* (0.014)
1(Bottom quintile)		0.221*** (0.010)		0.202*** (0.010)		0.142*** (0.011)	0.152*** (0.012)
1(Second quintile)		0.165*** (0.009)		0.150*** (0.009)		0.100*** (0.009)	0.105*** (0.010)
1(Third quintile)		0.127*** (0.009)		0.117*** (0.009)		0.077*** (0.009)	0.080*** (0.009)
1(Fourth quintile)		0.053*** (0.007)		0.048*** (0.007)		0.025*** (0.007)	0.026*** (0.007)
1(Bottom quintile)×1(2020-21 academic year)		-0.083*** (0.013)		-0.092*** (0.013)		-0.063*** (0.015)	-0.058*** (0.015)
1(Second quintile)×1(2020-21 academic year)		-0.062*** (0.011)		-0.071*** (0.011)		-0.045*** (0.012)	-0.041*** (0.012)
1(Third quintile)×1(2020-21 academic year)		-0.058*** (0.011)		-0.063*** (0.011)		-0.041*** (0.011)	-0.037*** (0.011)
1(Fourth quintile)×1(2020-21 academic year)		-0.020** (0.008)		-0.021** (0.008)		-0.008 (0.008)	-0.004 (0.008)
1(Less than high school diploma)			0.183*** (0.013)		0.169*** (0.013)	0.110*** (0.014)	0.099*** (0.014)
1(High school diploma)			0.160*** (0.007)		0.147*** (0.007)	0.100*** (0.008)	0.091*** (0.008)
1(Some college)			0.093*** (0.005)		0.084*** (0.005)	0.050*** (0.006)	0.047*** (0.006)
1(Less than HS diploma)×1(2020-21 academic year)			-0.044** (0.018)		-0.064*** (0.018)	-0.038** (0.019)	-0.039** (0.019)
1(High school diploma)×1(2020-21 academic year)			-0.078*** (0.009)		-0.080*** (0.009)	-0.056*** (0.010)	-0.054*** (0.010)
1(Some college)×1(2020-21 academic year)			-0.039*** (0.007)		-0.040*** (0.007)	-0.022*** (0.007)	-0.022*** (0.007)
Household size							0.005*** (0.002)
Number of children							0.006** (0.003)
1(Female, respondent)							-0.037*** (0.004)
1(Married, respondent)							-0.002 (0.005)
State average mobility, retail							0.592*** (0.131)
State average mobility, transit							-0.203* (0.118)
State average mobility, grocery							0.096 (0.104)
State average mobility, workplaces							-0.144 (0.099)
State average mobility, residential							0.506*** (0.122)
Average number of new cases, state							0.008 (0.023)
Constant	0.430*** (0.015)	0.335*** (0.015)	0.360*** (0.015)	0.337*** (0.015)	0.350*** (0.015)	0.318*** (0.015)	0.293*** (0.021)
Survey week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	451,951	451,951	451,951	451,951	451,951	451,951	451,951

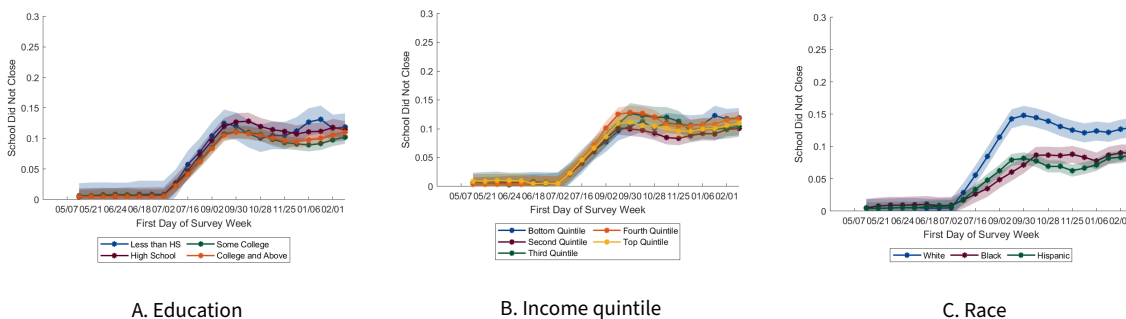
Notes: Stars denote statistical significance. * for p<.10, ** for p<.05, and *** for p<.01. Standard errors in parentheses.

Table 3. No School Closure, with 2020-21 Academic Year Interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	No Closure	No Closure	No Closure	No Closure	No Closure	No Closure	No Closure
1(Black)	-0.001 (0.001)			0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.006*** (0.001)
1(Hispanic)	0.011*** (0.001)			0.013*** (0.002)	0.012*** (0.001)	0.013*** (0.001)	0.009*** (0.001)
1(Other race)	0.020*** (0.003)			0.020*** (0.003)	0.020*** (0.003)	0.020*** (0.003)	0.013*** (0.003)
1(2020-21 academic year)	0.131*** (0.006)	0.102*** (0.006)	0.104*** (0.006)	0.120*** (0.006)	0.124*** (0.006)	0.117*** (0.006)	0.054*** (0.011)
1(Black)×1(2020-21 academic year)	-0.059*** (0.006)			-0.062*** (0.006)	-0.061*** (0.006)	-0.061*** (0.006)	-0.068*** (0.006)
1(Hispanic)×1(2020-21 academic year)	-0.058*** (0.004)			-0.060*** (0.004)	-0.064*** (0.004)	-0.064*** (0.004)	-0.056*** (0.004)
1(Other race)×1(2020-21 academic year)	-0.078*** (0.005)			-0.077*** (0.005)	-0.077*** (0.005)	-0.076*** (0.005)	-0.061*** (0.005)
1(Bottom quintile)		-0.008*** (0.002)		-0.010*** (0.002)		-0.010*** (0.003)	-0.002 (0.003)
1(Second quintile)		-0.010*** (0.002)		-0.012*** (0.002)		-0.012*** (0.003)	-0.007** (0.003)
1(Third quintile)		-0.011*** (0.002)		-0.012*** (0.002)		-0.012*** (0.003)	-0.008*** (0.003)
1(Fourth quintile)		-0.008*** (0.002)		-0.008*** (0.002)		-0.009*** (0.002)	-0.006*** (0.002)
1(Bottom quintile)×1(2020-21 academic year)		0.001 (0.006)		0.022*** (0.006)		0.010 (0.007)	0.002 (0.007)
1(Second quintile)×1(2020-21 academic year)		-0.007 (0.005)		0.009** (0.005)		0.002 (0.006)	-0.005 (0.006)
1(Third quintile)×1(2020-21 academic year)		0.008 (0.005)		0.016*** (0.005)		0.011** (0.006)	0.005 (0.006)
1(Fourth quintile)×1(2020-21 academic year)		0.012*** (0.004)		0.014*** (0.004)		0.012*** (0.004)	0.008* (0.004)
1(Less than high school diploma)			0.001 (0.002)		-0.003* (0.002)	0.001 (0.002)	0.002 (0.002)
1(High school diploma)			-0.004*** (0.001)		-0.004*** (0.001)	-0.000 (0.001)	0.001 (0.001)
1(Some college)			-0.001 (0.001)		-0.001 (0.001)	0.002 (0.002)	0.003* (0.002)
1(Less than high school diploma)×1(2020-21 academic year)			0.007 (0.008)		0.031*** (0.008)	0.030*** (0.009)	0.030*** (0.009)
1(High school diploma)×1(2020-21 academic year)			0.010** (0.004)		0.017*** (0.004)	0.016*** (0.005)	0.015*** (0.005)
1(Some college)×1(2020-21 academic year)			-0.002 (0.003)		0.002 (0.003)	0.000 (0.003)	0.001 (0.003)
Household size							-0.001 (0.001)
Number of children							0.000 (0.001)
1(Female, respondent)							-0.001 (0.002)
1(Married, respondent)							0.007*** (0.002)
State average mobility, retail							-0.831*** (0.045)
State average mobility, transit							0.348*** (0.047)
State average mobility, grocery							-0.316*** (0.046)
State average mobility, workplaces							-0.007 (0.047)
State average mobility, residential							-0.949*** (0.061)
Average number of new cases, state							-0.003 (0.010)
Constant	0.028*** (0.005)	0.040*** (0.005)	0.033*** (0.005)	0.036*** (0.005)	0.029*** (0.005)	0.036*** (0.005)	0.051*** (0.008)
Survey week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	451,951	451,951	451,951	451,951	451,951	451,951	451,951

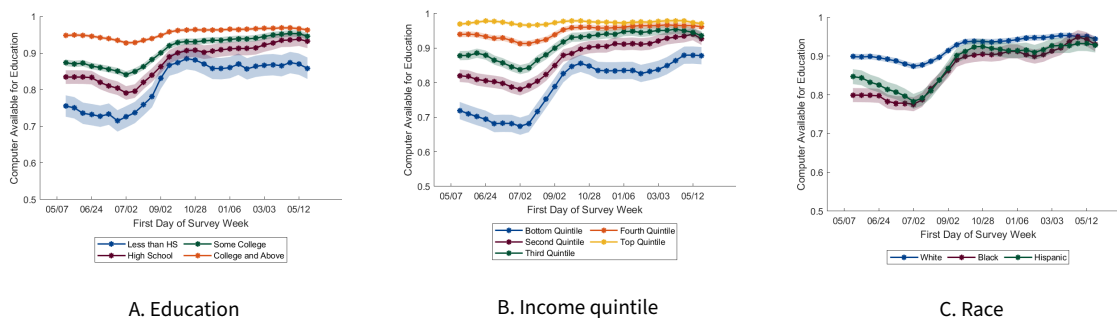
Notes: Stars denote statistical significance. * for p<.10, ** for p<.05, and *** for p<.01. Standard errors in parentheses.

Figure 3. How Did the Pandemic Affect the Way in Which Children Learn? Schools Remained Open



NOTE: Equally weighted five-survey week moving averages are presented.

Figure 4. Computer Available for Educational Purposes



NOTE: Equally weighted five-survey week moving averages are presented.

4. ACCESS TO COMPUTERS FOR EDUCATIONAL PURPOSES

We now investigate differences in children’s ability to adjust to the changes in the learning format as containment measures forced a shift toward remote learning. Figure 4 presents the differences in the availability of a computer for educational purposes with respect to household income and respondents’ education and race. Similarly, Table 4 presents the LPM results obtained upon controlling for other individual and household characteristics. Overall, there was a computer available for educational purposes in 88% of households with children enrolled in school (public or private) during the academic year of reference at the time of the survey. However, there exist noticeable gaps in the access to a computer for educational purposes in terms of respondents’ education and race and household income.

In terms of respondents’ education, while more than 90% of households with children enrolled in school and in which the respondent has a bachelor’s degree or higher reported having a computer available for educational purposes, less than 76% of households with children enrolled in school and in which the respondent has less than a high school diploma reported having a computer available for educational purposes between May and July, with this percentage increasing toward the start of fall. Panel A of Figure 5 shows that the reduction in the gap is primarily driven by an increase in the share of households with access to a computer for educational purposes towards the start of the 2020–21 academic year, indicating support from children’s schools in this regard. Reliance on schools for children having access to a computer in the household decreases with the respondents’ education: Figure 6 suggests that better-educated respondents were more likely to indicate that someone in their household or family provided the computer used by children for educational purposes.

Additionally, Figure 5 presents the differences in the percentages of households with access to a computer provided by the child’s school with respect to household income and the respondents’ education and race, and Figure 6 presents differences in the percentage of households with a computer supplied by someone in the child’s household/family for educational purposes with respect to the same characteristics.

There is a noticeable income gradient in the availability of a computer for children’s education, with the share of households having such a resource available increasing with household income. Similar to the observed differences with respect to respondents’ education, Panel B of Figure 5 shows that the reduction of the gap in computer availability is also driven by an increase in the share of households with access to a computer for educational purposes, indicating support from children’s schools in this regard. The income gradient observed

Table 4. Computer Available for Educational Purposes, with 2020-21 Academic Year Interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.
1(Black)	-0.097*** (0.007)			-0.031*** (0.007)	-0.078*** (0.007)	-0.032*** (0.007)	-0.029*** (0.007)
1(Hispanic)	-0.079*** (0.007)			-0.025*** (0.007)	-0.043*** (0.007)	-0.015** (0.007)	-0.013* (0.007)
1(Other race)	0.026*** (0.007)			0.026*** (0.007)	0.019*** (0.007)	0.025*** (0.007)	0.021*** (0.007)
1(2020-21 Academic Year)	0.022** (0.009)	-0.025*** (0.009)	-0.006 (0.009)	-0.027*** (0.009)	-0.014 (0.009)	-0.032*** (0.009)	-0.013 (0.016)
1(Black)×1(2020-21 academic year)	0.068*** (0.008)			0.029*** (0.008)	0.055*** (0.008)	0.028*** (0.008)	0.030*** (0.008)
1(Hispanic)×1(2020-21 academic year)	0.050*** (0.008)			0.023*** (0.008)	0.032*** (0.007)	0.018** (0.008)	0.021*** (0.008)
1(Other race)×1(2020-21 academic year)	-0.016** (0.008)			-0.014* (0.008)	-0.013* (0.008)	-0.014* (0.008)	-0.012 (0.008)
1(Bottom quintile)		-0.265*** (0.008)		-0.250*** (0.008)		-0.217*** (0.008)	-0.204*** (0.009)
1(Second quintile)		-0.164*** (0.006)		-0.152*** (0.006)		-0.127*** (0.006)	-0.118*** (0.007)
1(Third quintile)		-0.103*** (0.006)		-0.095*** (0.006)		-0.077*** (0.006)	-0.071*** (0.006)
1(Fourth quintile)		-0.041*** (0.003)		-0.037*** (0.003)		-0.027*** (0.003)	-0.025*** (0.003)
1(Bottom quintile)×1(2020-21 academic year)		0.138*** (0.010)		0.125*** (0.010)		0.107*** (0.010)	0.106*** (0.010)
1(Second quintile)×1(2020-21 academic year)		0.101*** (0.007)		0.090*** (0.007)		0.075*** (0.007)	0.074*** (0.007)
1(Third quintile)×1(2020-21 Academic Year)		0.067*** (0.007)		0.061*** (0.007)		0.049*** (0.007)	0.047*** (0.007)
1(Fourth quintile)×1(2020-21 academic year)		0.028*** (0.004)		0.025*** (0.004)		0.018*** (0.004)	0.017*** (0.004)
1(Less than high school diploma)			-0.201*** (0.011)		-0.181*** (0.011)	-0.095*** (0.011)	-0.091*** (0.011)
1(High school diploma)			-0.118*** (0.005)		-0.104*** (0.005)	-0.038*** (0.005)	-0.037*** (0.005)
1(Some college)			-0.077*** (0.004)		-0.067*** (0.004)	-0.021*** (0.004)	-0.021*** (0.004)
1(Less than high school diploma)×1(2020-21 academic year)			0.108*** (0.014)		0.092*** (0.014)	0.048*** (0.014)	0.049*** (0.014)
1(High school diploma)×1(2020-21 academic year)			0.069*** (0.006)		0.058*** (0.006)	0.020*** (0.006)	0.020*** (0.006)
1(Some college)×1(2020-21 academic year)			0.055*** (0.004)		0.047*** (0.004)	0.019*** (0.004)	0.019*** (0.004)
Household size							-0.002 (0.001)
Number of children							-0.021*** (0.002)
1(Female, respondent)							-0.009*** (0.002)
1(Married, respondent)							0.012*** (0.003)
State average mobility, retail							0.013 (0.088)
State average mobility, transit							-0.048 (0.070)
State average mobility, grocery							0.037 (0.061)
State average mobility, workplaces							0.076 (0.058)
State average mobility, residential							0.114 (0.073)
Average number of new cases, state							-0.008 (0.011)
Constant	0.892*** (0.009)	0.981*** (0.009)	0.939*** (0.009)	0.983*** (0.009)	0.954*** (0.009)	0.990*** (0.009)	1.028*** (0.013)
Survey week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	515,781	515,781	515,781	515,781	515,781	515,781	515,781

Notes: Stars denote statistical significance. * for p<.10, ** for p<.05, and *** for p<.01. Standard errors in parentheses.

Table 5. Computer Available for Educational Purposes, Provided by School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.
1(Black)	0.085*** (0.009)			0.047*** (0.009)	0.070*** (0.009)	0.048*** (0.009)	0.043*** (0.009)
1(Hispanic)	0.119*** (0.009)			0.085*** (0.009)	0.089*** (0.009)	0.073*** (0.009)	0.067*** (0.009)
1(Other race)	-0.027** (0.012)			-0.029** (0.012)	-0.023** (0.012)	-0.028** (0.011)	-0.023** (0.012)
1(2020-21 academic year)	0.265*** (0.013)	0.256*** (0.013)	0.264*** (0.012)	0.258*** (0.013)	0.265*** (0.013)	0.257*** (0.013)	0.320*** (0.027)
1(Black)×1(2020-21 academic year)	0.033*** (0.011)			0.037*** (0.011)	0.038*** (0.011)	0.038*** (0.011)	0.043*** (0.011)
1(Hispanic)×1(2020-21 academic year)	-0.016 (0.011)			-0.019* (0.011)	-0.010 (0.011)	-0.012 (0.011)	-0.004 (0.011)
1(Other race)×1(2020-21 academic year)	-0.028* (0.015)			-0.023 (0.014)	-0.020 (0.014)	-0.019 (0.014)	-0.015 (0.015)
1(Bottom quintile)		0.180*** (0.010)		0.148*** (0.010)		0.112*** (0.011)	0.093*** (0.012)
1(Second quintile)		0.140*** (0.009)		0.112*** (0.009)		0.084*** (0.009)	0.071*** (0.010)
1(Third quintile)		0.092*** (0.009)		0.074*** (0.009)		0.054*** (0.009)	0.044*** (0.009)
1(Fourth quintile)		0.055*** (0.007)		0.046*** (0.007)		0.036*** (0.007)	0.031*** (0.007)
1(Bottom quintile)×1(2020-21 academic year)		0.009 (0.013)		0.005 (0.014)		0.015 (0.015)	0.017 (0.015)
1(Second quintile)×1(2020-21 academic year)		0.018* (0.011)		0.018 (0.011)		0.025** (0.012)	0.025** (0.012)
1(Third quintile)×1(2020-21 academic year)		0.030*** (0.011)		0.029** (0.011)		0.034*** (0.012)	0.037*** (0.012)
1(Fourth quintile)×1(2020-21 academic year)		0.011 (0.009)		0.011 (0.009)		0.014 (0.009)	0.014 (0.009)
1(Less than high school diploma)			0.182*** (0.013)		0.148*** (0.014)	0.105*** (0.014)	0.109*** (0.014)
1(High school diploma)			0.103*** (0.007)		0.083*** (0.007)	0.047*** (0.008)	0.059*** (0.008)
1(Some college)			0.056*** (0.005)		0.042*** (0.005)	0.016*** (0.006)	0.023*** (0.006)
1(Less than high school diploma)×1(2020-21 academic year)			-0.038** (0.018)		-0.039** (0.018)	-0.049** (0.019)	-0.050*** (0.019)
1(High school diploma)×1(2020-21 academic year)			0.004 (0.009)		0.004 (0.010)	-0.003 (0.010)	-0.005 (0.010)
1(Some college)×1(2020-21 academic year)			0.004 (0.007)		0.003 (0.007)	-0.003 (0.007)	-0.003 (0.007)
Household size							-0.002 (0.002)
Number of children							0.044*** (0.003)
1(Female, respondent)							0.053*** (0.004)
1(Married, respondent)							0.014*** (0.005)
State average mobility, retail							-0.053 (0.129)
State average mobility, transit							-0.372*** (0.117)
State average mobility, grocery							0.163 (0.105)
State average mobility, workplaces							0.177* (0.099)
State average mobility, residential							0.272** (0.122)
Average number of new cases, state							-0.033 (0.021)
Constant	0.220*** (0.014)	0.150*** (0.014)	0.188*** (0.014)	0.148*** (0.015)	0.174*** (0.014)	0.141*** (0.015)	0.019 (0.020)
Survey week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	447,000	447,000	447,000	447,000	447,000	447,000	447,000

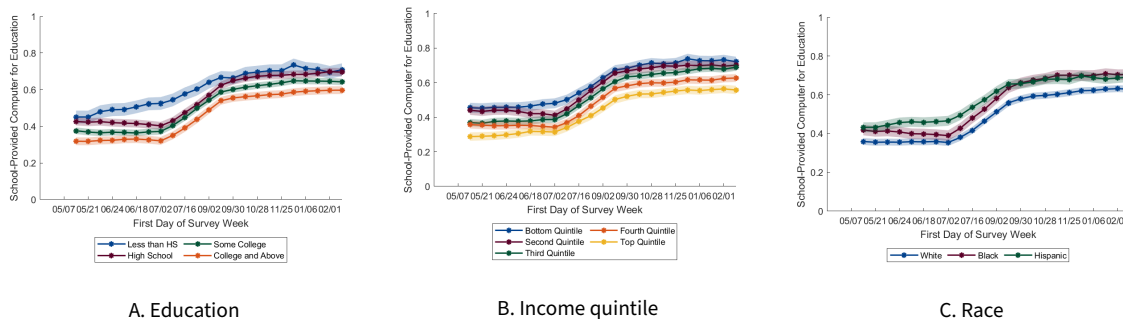
Notes: Stars denote statistical significance. * for $p < .10$, ** for $p < .05$, and *** for $p < .01$. Standard errors in parentheses.

Table 6. Computer Available for Educational Purposes, Provided by Household/Family

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.	Comp. Avail.
1(Black)	-0.133*** (0.008)			-0.068*** (0.009)	-0.109*** (0.008)	-0.069*** (0.009)	-0.067*** (0.009)
1(Hispanic)	-0.164*** (0.008)			-0.107*** (0.008)	-0.118*** (0.008)	-0.090*** (0.008)	-0.085*** (0.008)
1(Other race)	0.016* (0.010)			0.020** (0.010)	0.008 (0.010)	0.016 (0.010)	0.015 (0.010)
1(2020-21 academic year)	-0.164*** (0.013)	-0.139*** (0.013)	-0.155*** (0.012)	-0.138*** (0.013)	-0.154*** (0.013)	-0.134*** (0.013)	-0.202*** (0.025)
1(Black)×1(2020-21 academic year)	-0.042*** (0.011)			-0.040*** (0.011)	-0.045*** (0.011)	-0.042*** (0.011)	-0.048*** (0.011)
1(Hispanic)×1(2020-21 academic year)	-0.006 (0.011)			0.007 (0.011)	0.002 (0.011)	0.008 (0.011)	-0.003 (0.011)
1(Other race)×1(2020-21 academic year)	0.019 (0.013)			0.010 (0.013)	0.007 (0.013)	0.006 (0.013)	-0.001 (0.013)
1(Bottom quintile)		-0.289*** (0.009)		-0.247*** (0.010)		-0.189*** (0.010)	-0.176*** (0.011)
1(Second quintile)		-0.209*** (0.008)		-0.173*** (0.008)		-0.127*** (0.008)	-0.119*** (0.009)
1(Third quintile)		-0.137*** (0.008)		-0.114*** (0.008)		-0.079*** (0.008)	-0.072*** (0.008)
1(Fourth quintile)		-0.066*** (0.006)		-0.054*** (0.006)		-0.036*** (0.006)	-0.033*** (0.006)
1(Bottom quintile)×1(2020-21 academic year)		-0.061*** (0.013)		-0.055*** (0.013)		-0.049*** (0.014)	-0.049*** (0.014)
1(Second quintile)×1(2020-21 academic year)		-0.063*** (0.010)		-0.061*** (0.010)		-0.059*** (0.011)	-0.058*** (0.011)
1(Third quintile)×1(2020-21 academic year)		-0.055*** (0.011)		-0.053*** (0.011)		-0.055*** (0.011)	-0.056*** (0.011)
1(Fourth quintile)×1(2020-21 academic year)		-0.036*** (0.008)		-0.036*** (0.008)		-0.037*** (0.008)	-0.036*** (0.008)
1(Less than high school diploma)			-0.258*** (0.013)		-0.213*** (0.013)	-0.139*** (0.013)	-0.148*** (0.013)
1(High school diploma)			-0.177*** (0.007)		-0.150*** (0.007)	-0.091*** (0.007)	-0.104*** (0.007)
1(Some college)			-0.084*** (0.005)		-0.065*** (0.005)	-0.024*** (0.005)	-0.031*** (0.005)
1(Less than high school diploma)×1(2020-21 academic year)			-0.045** (0.018)		-0.042** (0.018)	-0.017 (0.019)	-0.016 (0.019)
1(High school diploma)×1(2020-21 academic year)			-0.021** (0.009)		-0.022** (0.009)	-0.004 (0.010)	-0.001 (0.010)
1(Some college)×1(2020-21 academic year)			-0.016** (0.006)		-0.016** (0.006)	-0.003 (0.007)	-0.002 (0.007)
Household size							0.002 (0.002)
Number of children							-0.020*** (0.003)
1(Female, respondent)							-0.056*** (0.004)
1(Married, respondent)							-0.023*** (0.005)
State average mobility, retail							0.106 (0.125)
State average mobility, transit							0.399*** (0.114)
State average mobility, grocery							-0.191* (0.103)
State average mobility, workplaces							-0.284*** (0.097)
State average mobility, residential							-0.366*** (0.119)
Average number of new cases, state							0.022 (0.022)
Constant	0.831*** (0.014)	0.938*** (0.014)	0.887*** (0.014)	0.940*** (0.014)	0.909*** (0.014)	0.952*** (0.014)	1.044*** (0.019)
Survey week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	447,000	447,000	447,000	447,000	447,000	447,000	447,000

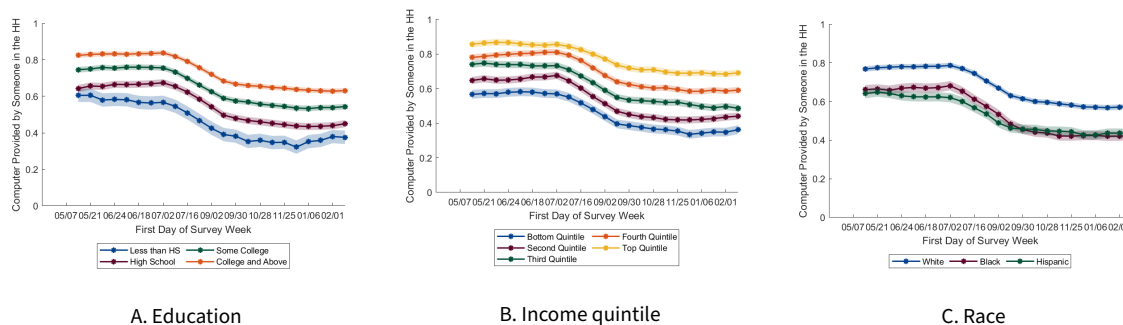
Notes: Stars denote statistical significance. * for p<.10, ** for p<.05, and *** for p<.01. Standard errors in parentheses.

Figure 5. Computer Available for Educational Purposes, Provided by Child’s School



NOTE: Equally weighted five-survey week moving averages are presented.

Figure 6. Computer Available for Educational Purposes, Provided by Someone in the Household or Family



NOTE: Equally weighted five-survey week moving averages are presented. Less than HS, less than a high school diploma; high school, high school graduate; college and above, bachelor’s degree or higher.

suggests that reliance on schools for providing children access to a computer decreases with household income, as Figure 6 indicates: Households in higher quintiles of the income distribution were more likely to report that someone in the household or family provided a computer for children in the household for educational purposes.

Regarding race, a higher share of White respondents’ households than Black or Hispanic respondents’ households had access to a computer for their children’s educational purposes. The racial gaps observed suggest that households’ reliance on schools for access to a computer is lower for White respondents’ households than for non-White respondents’ households, as Figure 6 suggests: White respondents’ households were more likely to indicate that someone in the family provides the computer used by children for education.

These patterns are consistent with the ones for the United Kingdom documented by Andrew et al., 2020. They find significant income gradients, particularly among primary school children’s households, in children’s access to active home-learning resources, as they observe that better-off households are more likely to provide children with the resources needed for learning such as a computer/tablet and a desk of their own.

5. CONCLUSION

Throughout the analysis implemented in this article, we assess how the unequal impact of COVID-19 on employment presented in Flores and Gayle, 2022 relates to the unequal impact of COVID-19 on children’s education. Specifically, using Pulse survey data on school-aged children’s education, we present evidence of the unequal impact of the pandemic on the education disruptions those children faced. Furthermore, we find that the estimated gradients in education disruptions align very well with those in food insecurity and households’ reliance on social insurance programs and other forms of government assistance to compensate for the losses in regular income sources generated by the pandemic.

When focusing on the impact of the COVID-19 pandemic on children’s education, we consider two essential aspects of children’s human capital formation affected by the pandemic: (i) schools’ responses to limitations imposed on in-person instruction, which significantly impacted how children learned during the pandemic, and (ii) active learning resources for school-aged children at home. Related to the latter, it is also essential

to distinguish the provider of such resources among children of different socio-demographic groups. This distinction suggests avenues for implementing policies to close observed gaps in active learning resources.

We document that children in households in the bottom quintile of the income distribution and children in non-White and non-college-educated respondents' households were significantly more likely to have had their classes cancelled at the earlier stage of the pandemic. Children from these groups were also considerably less likely to have their classes switched to a remote format. Similar disparities are observed in children's access to computers for learning purposes. These findings are of particular concern since there is evidence related to the impact of natural disasters indicating that significant education disruptions can negatively affect children's long-term education outcomes, especially if students cannot adapt to or compensate for these disruptions. Thus, children's education becomes constrained to the education-related investments made at home. Nonetheless, despite a weakening of the equalizing role of schools, schools still play an essential role in providing access to necessary learning resources to help students from disadvantaged groups—particularly those hit harder by employment income losses—adapt to the education disruptions experienced during the pandemic.

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